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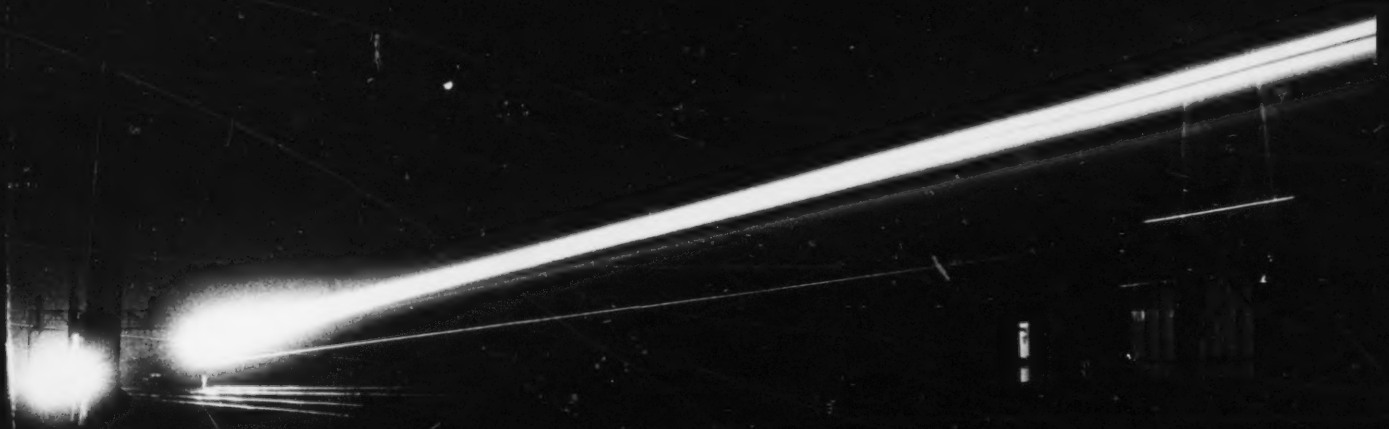
October 1986

Railway Age

...for the new age of railways

Advanced train controls signal reduced costs



The optical fiber options

Coal keeps C&NW in the black

What makes Toronto Transit different

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The Advanced Train Control Systems Project is designed not only to reduce train operation costs but also to provide a more marketable transportation product.

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Conrail signal bridge near Buffalo, N.Y. photographed by Kent Patterson.

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Market Outlook

Facilities

Conrail: Completed construction of an $800,000 computerized materials warehouse adjacent to its diesel locomotive servicing facility at Collinwood, Ohio. Jeremy T. Whatmough, vice president-materials & purchasing, said the new warehouse "will greatly improve operating efficiency at the terminal because in the past, parts for the terminal were stored within the existing shop and in trailers and open storage areas."

Metropolitan Atlanta Rapid Transit Authority: General Railway Signal is the apparent low bidder, at $4.1 million, for equipping MARTA's South Yard. GRS will provide the engineering and 34 switch machines, 41 signals, a factory-wired electronic equipment housing and train traffic control office equipment. The project is to be completed in June 1988.

Equipment

Maryland DOT: Awarded a $10.5-million contract to Sumitomo Corp. of America for 13 new cars that are scheduled to go into MARC (Maryland Rail Commuter) service in 1987. They will be identical to 15 MARC II cars that were placed in service in December 1985. Car bodies will be built in Japan by Nippon Sharyo; final assembly will be done by General Electric in Cleveland. About 60% of the value of the contract will be spent in the U.S. The new cars will be used primarily on the line that runs from Camden Station in Baltimore to Union Station in Washington, D. C. Ridership on this line has exceeded seating capacity in recent months, according to State Railroad Administrator Richard Keen.

New York City Transit Authority: Placed an order with Westinghouse-Amrail for an additional 200 R-68 cars, for service on the Astoria/Sea Beach lines. An earlier order for 225 cars, for use on NYCTA's "D" and "Q" lines, is now being delivered. Under the contract with Westinghouse-Amrail, NYCTA has an option to purchase still another 200 cars. The original order was priced at $1.18 million per car.

Revenue freight carloadings

Commodity	Sept. 13 week	Sept. 6 week	Aug. 30 week	Aug. 23 week
Grain	28,288	20,789	23,073	25,116
Other farm products	3,838	2,466	2,711	2,848
Metallic ores	17,191	15,319	14,149	16,381
Coal	117,392	97,986	112,828	117,441
Crushed stone, gravel and sand	15,007	11,923	14,816	15,090
Nonmetallic minerals	8,358	7,196	7,541	8,726
Grain mill products	10,817	9,179	10,487	10,420
Food and kindred products	10,777	9,328	10,771	10,789
Primary forest products	10,455	8,316	10,229	9,999
Lumber and wood products except furniture	7,917	6,282	8,420	7,956
Pulp, paper and allied products	12,473	12,093	12,603	12,755
Chemicals and allied products	25,051	21,656	25,776	24,044
Petroleum products	4,561	3,921	5,178	4,963
Stone, clay and glass products	10,632	8,807	10,890	10,403
Coke	3,442	3,606	3,674	3,498
Metals and products	7,291	6,430	7,805	7,140
Motor vehicles and equipment	20,563	16,432	18,854	17,757
Waste and scrap materials	7,642	6,343	7,966	7,778
Forwarder and shipper assn. traffic	3,395	2,913	3,684	3,398
All other carloads	69,317	60,456	71,785	69,083
LCL traffic	90	111	93	79
Total Cars Loaded	**394,497**	**331,552**	**383,323**	**385,624**
% change from previous year	0.3	(0.4)	(2.6)	(0.0)
Estimated revenue ton-miles (billions)	17.5	15.1	17.5	17.4
% change from previous year	2.3	3.6	1.3	1.7

Total:	**1986**	**1985**	**% change**
37 weeks	624.0	625.7	(0.3)

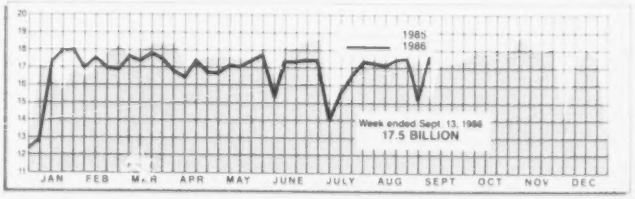
Piggyback loadings

	Sept. 6 week	Aug. 30 week	Aug. 23 week	Aug. 16 week
Trailers/containers	86,822	104,750	99,388	98,014

Cumulative total, 36 weeks		**% change from 1985**
Trailers/containers	3,381,855	9.4

Rail freight traffic trends

Billion ton-miles (Estimated)



Source: Association of American Railroads

Freight cars

	DELIVERED August 1986	DELIVERED 8 months 1986	DELIVERED 8 months 1985	ORDERED August 1986	ORDERED 8 months 1986	ORDERED 8 months 1985	ON ORDER AND UNDELIVERED Sept. 1, 1986	Average Backlog 1986	Average Backlog 1985
Built new by carbuilders	1,161	6,402	7,646	1,081	8,345	6,702	3,702	3,621	4,036
Built new in RR shops	0	0	406	0	0	0	0	0	0
Built new—total	**1,161**	**6,402**	**8,052**	**1,081**	**8,345**	**6,702**	**3,702**	**3,621**	**4,036**
Rebuilt	0	50	0	0	75	0	25	16	0
TOTAL	**1,161**	**6,452**	**8,052**	**1,081**	**8,420**	**6,702**	**3,727**	**3,637**	**4,036**
Locomotives (new and rebuilt)	29	253	373	N/A	N/A	N/A	109	162	260

Source: Transportation Div., AAR and American Railway Car Institute

REVENUES AND EXPENSES OF RAILWAYS

Second quarter figures of calendar year 1986

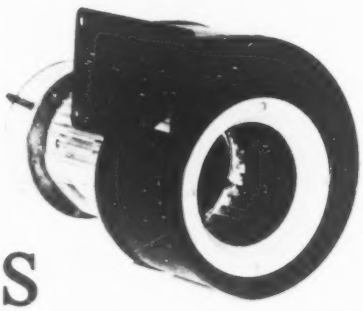
(Dollar figures are stated in thousands, i.e., with last three digits omitted)

		Operating revenues				Operating expenses													
						Way & structures			Equipment										
		Freight	Other	Total 1986	Total 1985	Total 1986	Total 1985	1986 Deprec.	Total 1986	Total 1985	1986 Deprec.	Total 1986	Total 1985	Operating Ratio 1986	Operating Ratio 1985	Income after fixed charges 1986	Income after fixed charges 1985	1986 Net Ry. operating income	Net income 1986	Net income 1985
Amtrak	3 mos.	—	209,897	209,897	217,420	52,737	57,578	17,098	95,448	95,884	21,111	386,746	399,390	184.25	183.69	(170,846)	(176,879)	(176,849)	(170,846)	(176,879)
	6 mos.	—	404,081	404,081	392,964	105,424	120,256	33,599	188,614	194,655	42,167	771,914	806,538	191.02	205.24	(356,990)	(402,278)	(367,833)	(356,990)	(402,278)
Atchison, Topeka & Santa Fe	3 mos.	461,564	10,019	471,583	543,030	85,956	89,638	16,395	114,277	122,138	22,822	437,660	497,786	92.80	91.66	27,775	40,588	27,537	21,155	32,712
	6 mos.	959,321	21,368	980,689	1,092,134	172,068	181,180	32,672	233,997	252,849	46,304	912,871	1,022,150	93.08	93.59	55,344	74,881	53,436	40,495	60,281
Boston & Maine	3 mos.	15,412	872	16,284	30,237	2,808	3,921	442	7,239	9,478	80	19,990	29,163	122.75	96.44	(3,069)	1,162	(3,632)	(3,069)	1,162
	6 mos.	38,491	1,863	40,354	59,033	6,508	8,077	884	15,973	18,477	160	45,187	57,725	111.97	97.78	(379)	2,079	(4,685)	(379)	2,079
Burlington Northern	3 mos.	895,040	20,595	915,635	1,001,700	512,254	146,863	398,698	218,170	180,702	44,847	1,181,248	805,396	129.00	80.40	(274,709)	196,249	(122,531)	(467,486)	114,497
	6 mos.	1,839,449	43,289	1,882,738	2,057,296	669,034	319,019	442,951	407,138	368,383	62,156	2,006,688	1,667,243	106.58	81.04	(138,344)	395,291	(39,006)	(389,265)	233,200
Chicago & North Western	3 mos.	181,117	24,373	205,490	208,480	38,863	38,890	6,417	49,313	47,991	3,486	193,043	198,252	93.94	95.09	4,770	2,375	12,265	4,620	2,575
	6 mos.	367,970	50,284	418,254	413,114	78,427	79,155	13,080	98,336	97,095	6,954	395,976	405,548	94.67	98.16	8,299	(12,510)	22,419	8,399	(10,335)
Conrail	3 mos.	774,528	23,307	797,835	824,662	109,109	107,902	24,217	168,794	172,618	32,827	657,700	691,253	82.43	83.82	144,945	154,812	101,539	144,945	154,812
	6 mos.	1,508,796	49,790	1,558,586	1,613,334	235,409	238,298	49,197	345,775	359,316	68,003	1,371,896	1,434,241	88.02	88.89	204,727	209,465	132,849	204,727	209,485
CSX	3 mos.	1,141,823	35,258	1,177,081	1,237,533	159,320	166,634	37,615	296,806	303,198	32,721	987,756	1,070,255	83.91	86.48	181,987	158,070	119,637	111,547	108,921
	6 mos.	2,250,813	66,741	2,317,554	2,439,761	313,945	340,757	74,228	583,747	614,690	67,774	1,993,791	2,159,219	86.02	88.50	297,102	283,288	212,989	181,950	189,819
Delaware & Hudson	3 mos.	17,646	242	17,888	27,659	3,690	4,297	365	7,219	7,530	134	20,117	27,001	112.46	97.62	(3,059)	1,007	(2,216)	(3,059)	1,007
	6 mos.	42,563	699	43,262	53,959	8,936	9,276	729	15,731	15,986	269	46,452	56,296	107.37	104.33	(4,801)	(2,425)	(3,164)	(4,801)	2,425
Denver & Rio Grande Western	3 mos.	76,979	955	77,934	84,438	12,576	12,905	3,541	14,579	15,190	3,321	68,057	74,234	87.32	87.91	11,302	8,724	4,901	6,178	5,286
	6 mos.	151,342	2,321	153,663	169,456	24,730	27,032	7,003	29,325	30,850	6,647	134,313	151,141	87.40	89.19	19,774	18,036	10,964	11,099	11,281
Elgin, Joliet & Eastern	3 mos.	14,210	5,743	19,953	23,831	6,621	3,502	603	3,250	3,622	1,828	19,238	21,735	96.41	91.20	2,677	3,633	(173)	1,789	1,978
	6 mos.	28,122	12,594	40,716	44,538	10,090	6,573	1,202	6,865	6,879	3,749	40,376	42,058	99.16	94.43	3,708	5,453	(909)	2,459	3,113
Florida East Coast	3 mos.	28,610	681	29,291	28,048	4,528	4,866	1,233	5,286	5,801	1,307	22,765	23,269	77.72	82.96	8,950	10,362	2,064	4,498	6,151
	6 mos.	57,622	1,550	59,172	59,376	9,167	9,636	2,481	10,045	11,363	2,558	45,542	46,003	76.96	77.47	17,978	22,133	4,747	9,095	12,609
Grand Trunk Western	3 mos.	82,033	3,943	85,976	85,729	9,850	10,796	1,720	19,046	19,351	1,606	86,522	84,877	100.63	99.00	10,114	349	(848)	10,679	2,444
	6 mos.	161,629	7,440	169,069	174,531	20,293	21,365	3,440	38,951	36,518	3,232	176,300	172,114	104.27	98.61	3,637	655	(6,380)	5,138	3,818
Illinois Central Gulf	3 mos.	153,029	17,828	170,857	223,415	23,835	27,832	9,610	58,864	68,517	4,309	168,838	210,751	98.81	94.33	(2,313)	6,252	8,242	3,748	5,580
	6 mos.	334,962	37,656	372,618	465,275	50,102	59,709	20,051	120,843	140,073	8,781	339,145	440,772	91.01	94.73	23,341	11,116	31,719	21,263	9,105
Kansas City Southern	3 mos.	67,231	3,364	70,595	82,283	12,458	12,181	4,512	16,097	17,869	5,237	60,827	69,612	86.16	84.60	7,795	10,736	6,781	4,589	6,660
	6 mos.	144,641	7,148	151,789	161,307	25,305	23,296	8,173	31,864	36,188	10,323	126,894	139,330	83.59	86.37	21,953	18,062	16,868	13,623	10,953
Missouri-Kansas-Texas	3 mos.	55,562	2,799	58,361	71,404	11,464	13,474	2,738	14,489	16,546	1,810	56,270	66,184	96.41	92.68	4,200	2,912	2,348	4,200	2,912
	6 mos.	114,070	5,704	119,774	137,096	21,865	25,933	5,676	28,686	32,666	3,726	114,967	129,293	95.98	94.30	5,420	2,814	5,327	5,420	(2,986)
Missouri Pacific	3 mos.	391,413	10,001	401,414	412,573	65,611	61,801	13,933	100,529	104,385	19,447	359,827	399,068	89.63	96.72	24,855	2,629	160,309	(130,826)	1,595
	6 mos.	801,450	23,357	824,807	855,249	125,388	126,701	27,569	201,672	207,539	38,984	733,924	802,823	88.98	93.87	54,033	29,817	203,425	(110,217)	29,222

Norfolk & Western	3 mos.	408,642	15,845	424,487	452,027	60,398	55,417	12,604	84,831	84,599	14,112	321,740	327,303	75.79	72.40	126,610	141,792	50,881	74,216	83,248
	6 mos.	811,380	31,945	843,325	878,506	126,362	117,301	24,945	171,947	171,961	27,375	661,913	678,759	78.48	77.26	217,394	235,287	91,861	126,731	139,216
St. Louis Southwestern	3 mos.	89,121	1,135	90,256	98,896	15,590	13,584	4,720	21,222	26,396	5,244	83,176	94,830	92.15	95.88	7,124	5,565	4,606	4,650	3,787
	6 mos.	173,645	2,536	176,181	199,301	28,107	28,504	9,583	42,185	54,080	10,476	164,913	192,315	93.60	96.49	12,979	10,066	7,045	8,756	6,520
Soo Line	3 mos.	147,655	4,405	152,060	165,585	30,570	34,354	7,331	39,647	42,173	3,476	149,874	166,564	98.56	100.59	2,494	(11,020)	5,404	4,948	(4,716)
	6 mos.	299,919	8,701	308,620	284,976	60,511	55,341	14,519	73,877	70,670	6,807	302,757	279,525	98.10	98.08	3,441	(8,324)	8,936	5,321	(2,945)
Southern Pacific	3 mos.	479,504	18,578	498,082	537,333	73,892	65,217	24,872	127,127	143,857	21,042	479,507	521,813	96.27	97.11	26,546	28,336	21,961	29,530	31,225
	6 mos.	932,007	36,129	968,136	1,057,963	146,013	142,451	49,222	262,230	296,965	41,494	1,012,733	1,069,788	104.60	101.11	(8,055)	107	(38,003)	(2,262)	4,814
Southern	3 mos.	421,241	8,880	430,121	434,787	58,068	63,913	16,560	84,542	89,877	20,953	322,546	340,265	74.98	78.26	109,714	92,244	64,428	65,158	54,727
	6 mos.	846,641	18,829	865,470	867,904	127,156	125,996	34,602	173,566	183,899	39,286	669,827	701,505	77.39	80.82	194,999	166,413	120,696	117,293	97,835
Union Pacific	3 mos.	481,452	4,549	486,001	484,529	61,171	72,902	18,349	94,705	88,236	22,504	375,862	402,771	77.33	83.12	104,565	80,421	295,435	(139,754)	56,991
	6 mos.	952,135	9,460	961,595	971,306	131,254	145,135	36,650	192,599	192,788	44,428	777,286	838,956	80.83	86.37	192,685	137,066	266,155	(85,125)	92,956
Western Pacific	3 mos.	43,021	463	43,484	42,117	7,681	10,125	1,514	11,384	11,493	1,014	44,350	51,758	101.99	122.89	(6,423)	(14,680)	16,027	(17,579)	(7,527)
	6 mos.	83,454	971	84,425	75,172	13,281	16,178	2,984	19,935	19,181	2,050	82,822	89,750	98.10	119.39	(3,035)	(18,138)	17,808	(14,879)	(7,933)

Source: Interstate Commerce Commission

Give Brush Motors the Brush-Off.



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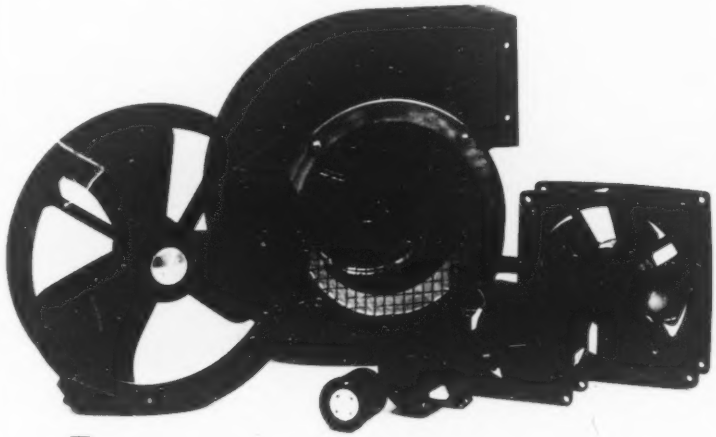

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Watching Washington

Where the railroads are investing their capital dollars

The dramatic shift that has taken place in recent years in the way railroads invest their capital dollars is highlighted in the just-published 1986 edition of *Railroad Ten-Year Trends*, which is compiled by the Economics and Finance Department of the Association of American Railroads.

In 1976, the railroads spent 68 cents of every capital improvement dollar on equipment (locomotives and freight cars), and 32 cents on roadway and structures.

That time-honored relationship—about one-third plant, two-thirds rolling stock—held pretty steady through the year 1980. It was in 1981 that the equipment glut came to be really apparent; that year, 53 cents went for rolling stock and 47 cents for plant. In 1983, when freight-car orders reached an all-time low, rolling stock got only 16.5 cents of the investment dollar and plant got 83.5 cents.

Since that time there has been a slight reversal of the trend. Last year, rolling stock was back to 21.9 cents of the total. This year, with freight-car orders running about 25% ahead of '85 levels, rolling stock will make a further small recovery in its capture of total capital outlays.

In dollar outlays, the 1985 capital-spending picture shaped up like this:

Out of total expenditures of $4,422,903,000, fixed plant got $3,458,015,000, of which $81,467,000 went for communications, $142,370,000 for signals and interlockings, and $3,324,178,000 for "other road," mostly improvements to track. Equipment expenditures added up to $964,888,000: locomotives, $660,917,000; freight cars, $162,445,000; and other equipment, $145,526,000.

Another document just published by the AAR's Economics and Finance Department (and available to new subscribers for $75) is *Analysis of Class I Railroads, 1985*. It contains 778 lines of operating and financial statistical data for each of the Class I railroads, including a breakdown of how they spent their capital dollars.

It concludes with industry rankings—first by railroad, then by system.

Among railroads, the Burlington Northern last year ranked first in all except one category. BN produced 20.99% of all revenue ton miles, operated 16.66% of all road miles and 14.53% of all track miles, collected 14.65% of all operating revenues and 14.83% of all freight revenues, and earned 27.32% of all ordinary (net) income and 26.24% of all net railway operating income. BN accomplished this with a plant representing 14.44% of total railway investment, with 12.69% of the total workforce, and with 12.25% of all owned and leased locomotives. BN ranked only fifth in the number of owned and leased freight cars, with 8.15% of the total (Seaboard was first with 12.20%).

Among railroad systems, a different picture emerged. While BN remained first in miles of road operated (16.66%), CSX was first in miles of track (15.45%), in both operating revenues (16.99%) and freight revenue (17.06%), in net investment (16.60%), and in number of employees (17.23%). BN retained first place in net railway operating income (26.24%), but Norfolk Southern was first in ordinary (net) income (27.35%).

1985 spenders: How they ranked

1.	Burlington Northern	$678,613,000
2.	Seaboard	595,723,000
3.	Conrail	513,250,000
4.	Santa Fe	414,452,000
5.	Missouri Pacific	382,569,000
6.	Norfolk & Western	327,000,000
7.	Southern	318,000,000
8.	Southern Pacific	252,092,000
9.	Union Pacific	235,951,000
10.	Chesapeake & Ohio	157,286,000
11.	Baltimore & Ohio	113,696,000
12.	Western Pacific	79,380,000
13.	Illinois Central Gulf	73,872,000
14.	Chicago & North Western	66,750,000
15.	Kansas City Southern	41,517,000
16.	St. Louis Southwestern	37,688,000
17.	Missouri-Kansas-Texas	23,980,000
18.	Denver & Rio Grande	23,708,000
19.	Delaware & Hudson	22,415,000
20.	Soo Line	21,403,000
21.	Grand Trunk Western	20,806,000
22.	Florida East Coast	16,165,000
23.	Elgin, Joliet & Eastern	4,304,000
24.	Boston & Maine	2,167,000

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Telex: 22065 SHEAF AR

Southeast Asia
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China Consultants International
Suite 905, Guardian House
32, Oi Kwan Road
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Lines on Labor

How railroads trim layers of management fat

Organized labor is not always its own worst enemy—just sometimes. There is, for example, the case of United Airlines' pilots, who couldn't reach agreement with management on how to handle wage scales for pilots at Frontier, an airline United wanted to buy. United told Frontier's parent "No deal," Frontier ceased operations and went into Chapter 11. Thousands of jobs were lost. There is, for example, the case of the rail unions' battle against the short line regional-railroad movement. With nonunion operation or with substantial concessions from employees who are organized, these smaller railroads can restore economic vitality to lines that larger railroads saw as unmitigated losers, mainly because of labor costs and work rule restrictions on operations. This short line regional movement is preserving service, preserving jobs. Many, perhaps most, employees of the big road are picked up by the smaller road when the transfer takes place. But labor wants New York Dock and Oregon Short Line protective provisions attached, provisions that would guarantee up to six years' full wages to every employee affected by the transfer (*RA*, September, p. 20).

GUS WELTY

For some reason, these sunk-in-concrete labor positions bring to mind the situation facing other thousands of railroad employees—those in management who see their employers eagerly embracing one or another buyout strategies.

There are sound reasons for a company to start a buyout program. Under regulation and sometimes through mergers, many railroads got fat and stayed that way. Under deregulation, the fat has become too much to carry. Attrition isn't fast enough, and so the buyout is the logical approach.

It's safe to say that no two buyout programs are exactly alike. It's also safe to say that none, not a one, follows the New York Dock-Oregon Short Line pattern, something which labor might do well to note. Often as not, managerial buyout payments are measured by the month, not the year.

Some programs are almost brutally direct—the well-known "offer you can't refuse." Some are a bit more subtle, with the offer open across-the-board or almost so, and with management reserving the right to keep the people it really wants to keep. (What happens if somebody whom management wants to drop doesn't bite? "Well," as one top manager puts it, "when a new organization chart starts getting around and your job isn't on it, that's a pretty strong hint.")

But then, what happens to the people who are bought-out? Where do they go? What do they do?

Some older managers, those who have put a few bucks away, simply retire. Younger managers, however, have a problem. More today than a few years ago, railroad managerial skills are transferrable to other industries—the catch being in finding another industry that's hiring. Managers with genuine marketing and logistics skills will probably fare best; logistics experts in particular seem to be in short supply.

How about becoming a consultant? Never mind that the world sometimes seems loaded with retired-railroaders-turned-consultants; opportunities do exist, as companies pare staff costs and contract for what they need as they need it on the outside. But consulting is not an easy life. Multiple lines have to be constantly out—and as one consultant once put it with respect to a particular prospective client, "I keep baiting the hook, but the damn worm keeps falling off."

Generous buyouts, those that are perceived to be fair, can go smoothly. Buyouts that are brutal can lead to lawsuits, and have.

And yes, perhaps another point might be made. Staff reductions that have as their sole purpose cost-cutting are short-sighted staff reductions. Staff reductions that go in tandem with a reduction in layers of management are the ones that will work, the ones that will both cut costs and improve efficiency.

What's happened in Burlington Northern's marketing department is a prime example of the latter. Today, there are only two or three layers between individual market manager and chief executive officer. Bill Greenwood, who heads the department, puts it simply. The trimmer and flatter an organization chart gets, he believes, the quicker and better the decisions become, and this is a key to developing a strong customer-focus. Conversely, he says, the more layers of management there are, the greater is the focus inward. And Burlington Northern, Bill Greenwood declares, "has become a market-driven company."

So, the times do demand the buyout, the restructuring. Equally demanded is fairness on management's part in dealing with lives, careers, futures.

And organized labor? On its part, the demand is for recognition that "No" is no longer an adequate response—and that less can sometimes really mean more.

Class 1 railroad employment

Employee Group	No. of employees, mid-month count July 1986	Percent of change July 1986 from July 1985	Percent of change July 1986 from June 1986
Total—all employees	279,697	d 8.27	1.23
Executives, officials and staff assistants	13,155	d 3.99	d 1.02
Professional and administrative	50,429	d 11.76	d .63
Maintenance of way and structures	62,374	d 6.21	5.80
Maintenance of equipment and stores	50,802	d 8.05	d .47
Transportation (other than train and engine)	18,038	d 9.87	d .56
Transportation (train and engine)	84,899	d 8.02	.91

Source: ICC

Update

Trailer Train board rejects sale proposal, declares a dividend

Those who say "Let Trailer Train be Trailer Train" can flash a victory sign, at least for now.

For some time, it appeared that Trailer Train, essentially railroad-owned since its inception, might be sold in some fashion. As recently as a month ago, about two-thirds of the ownership was interested in a sale. But it became evident that nobody was interested in buying, with such a sizeable minority not interested in selling.

And so on Sept. 11, Trailer Train directors voted—by a wide margin—to maintain the status quo.

At the same time, the directors also voted in favor of the company's declaring another dividend, which would be the second in TT's history. A $19-million dividend was declared last April, and the amount of additional dividend to be declared for 1986 was to be decided at another board meeting which was scheduled for Oct. 2.

Trailer Train is in good financial condition, with liabilities from its ventures into boxcar and gondola ownership made manageable by present management. Its capital-spending programs for 1984-86 have been at a relatively high level, and its '86 program has been expanded (*RA*, September, p. 23). But those programs came after several years, 1981-83, of modest spending. And the recent expenditures have served owning-lines well in terms of upgrading both the technology and the supply of intermodal and auto-rack cars.

At the same time, Trailer Train has continued to operate more as a service company than as a company primarily interested in profit. Emphasis has been on maintaining an adequate supply of technologically up-to-date equipment and on streamlining operations to keep lease rates low. Over the past two years, rates have been reduced by 17%. A rate increase may now be needed, depending upon the dividend level that was to be set Oct. 2.

Trailer Train has 37 directors; a number of major roads have multiple directorships, for the most part reflecting merger of owner-lines.

Return on investment drops below 4%

For the 12 months ended June 30, the railroads' rate of return on net investment dropped to 3.97%, a full percentage point below the return reported for the corresponding period a year earlier.

During the quarter that ended June 30, net revenue from operations dropped to $524 million, down 43.4% from second quarter 1985. For the first six months of this year, net revenue from operations was $1.184 billion, a drop of 23.4% from the comparable 1985 period.

Due to write-downs taken by Burlington Northern and Union Pacific, the industry's second quarter ordinary (net) income dropped by 95%, to $31 million, compared with $632 million in the second quarter of 1985. Without these write-downs, which accounted for $537 million of the $601-million decrease, ordinary income would have dropped $64 million, or 10.1%. For the first half of 1986, ordinary income amounted to $435 million, down 57.8% from the 1985 period.

Class I Railroads in the United States

For the First Six Months

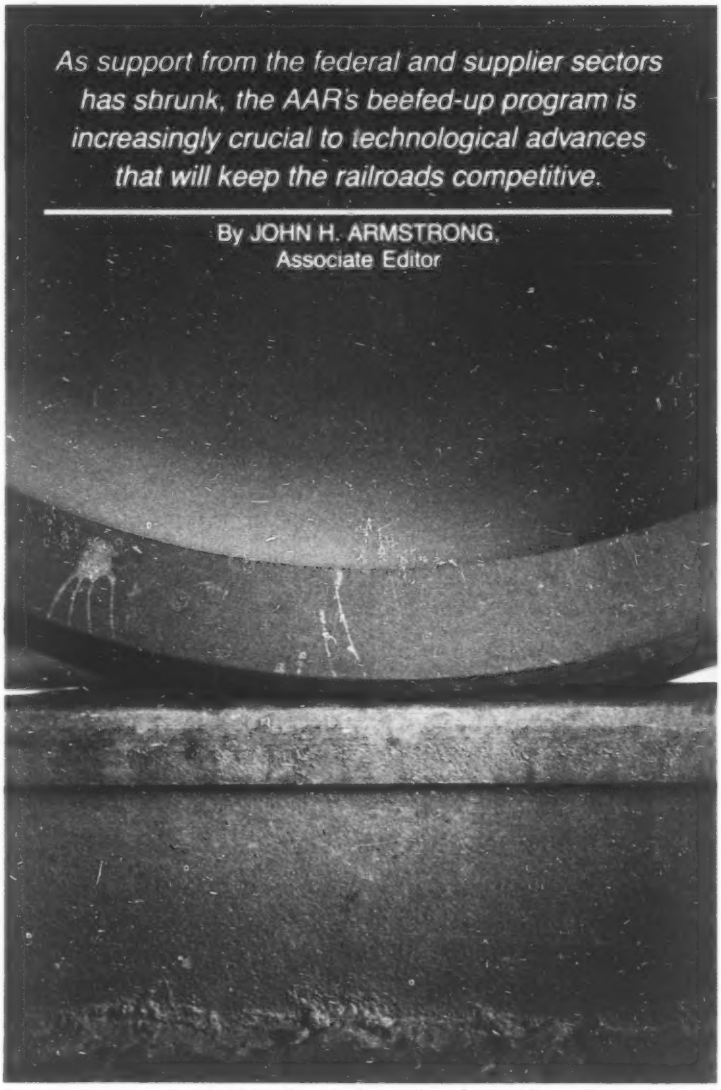
		1986 (millions)	1985 (millions)
Operating revenues		$13,341	$14,180
Operating expenses		12,157	12,634
Net revenue from operations			
United States		1,184	1,546
Eastern District[1]		920	868
Western District		264	678
Rate of return on net investment[2]		3.97%	4.97%
Ordinary income			
United States		435	1,034
Eastern District[1]		606	618
Western District	(def.)	173	415
For the Second Quarter			
Operating revenues		$6,641	$7,100
Operating expenses		6,117	6,174
Net revenue from operations			
United States		524	926
Eastern District[1]		543	542
Western District	(def.)	19	384
Net railway operating income		705	645
Ordinary income			
United States		31	632
Eastern District		371	386
Western District	(def.)	340	246

[1] Eastern District includes what was formerly the Eastern and Southern Districts.
[2] Rate of return for the 12 months ended June 30, 1986.
(def.) - deficit

R&D: A new 5-year plan

As support from the federal and supplier sectors has shrunk, the AAR's beefed-up program is increasingly crucial to technological advances that will keep the railroads competitive.

By JOHN H. ARMSTRONG,
Associate Editor



Guided-wheel-on-rail technology, the very foundation of railroading, will get increased attention in the AAR's 1987-1991 program. Edward Delvers

Two years ago, it had become clear that the level of freight transportation demand in North America had become at best a static thing; that intensifying competitive pressures wouldn't diminish; that already reduced federal rail research support had more years of decline in prospect; and that supplier-funded research and development, shrunken by the lowest level of car orders in 50 years, couldn't be expected to rebound.

It was equally clear that the railroads must base their hopes for future financial health on carrying more of a constrained gross through to the bottom line—and that to do this they would need to generate transportation of enhanced, competitive quality at lower cost. Doing that in an industry founded from its beginnings on the strength of a specific technology means that fundamental technology must continue to be improved, even as it copes with a changing environment. How? By research. The need for a stepped-up R&D effort was apparent, and the hour late.

So it was that in 1984 the board of directors of the Association of American Railroads kicked off an expanded five-year research program by approving a first-year (1985) budget up 34% from previous levels.

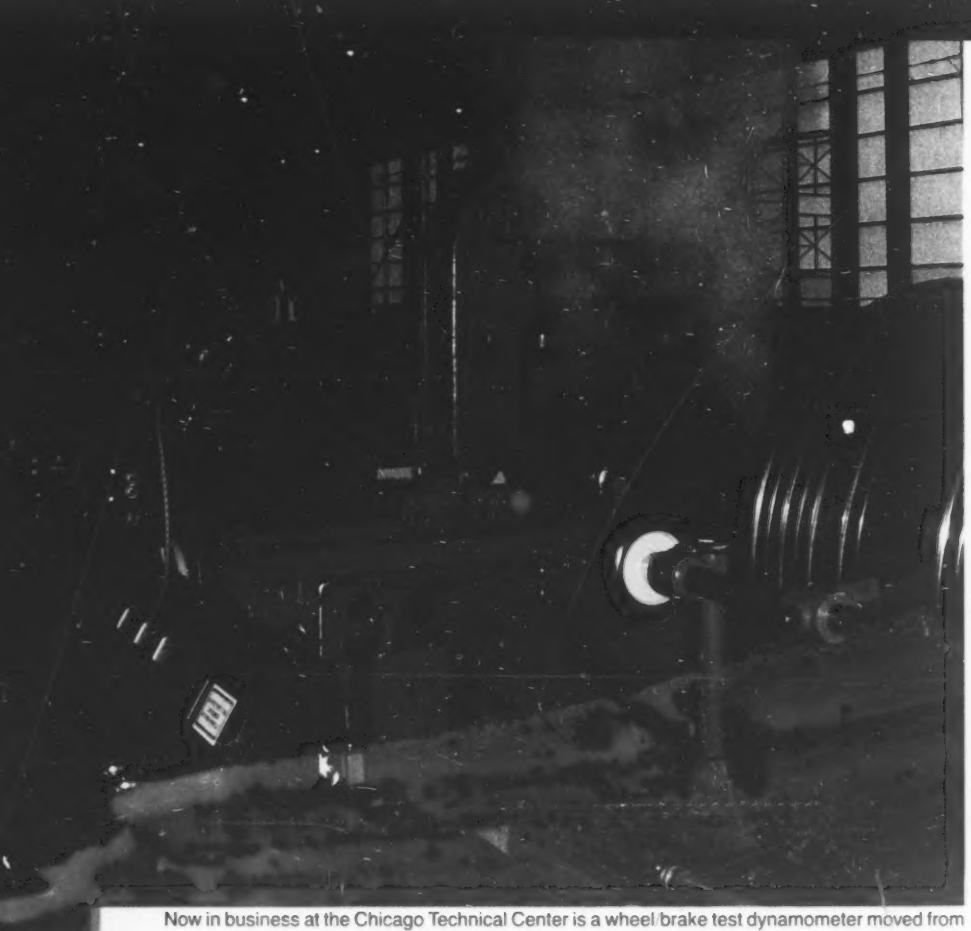
Two years have now gone by, and the scheduled biennial update of the five-year plan is in hand (see box, p. 43). Preceding that stepped-up 1985 program, and reflected in the distribution of work within it, was the AAR's assumption of management responsibility for the Transportation Test Center at Pueblo, Col. from the Federal Railroad Administration. Since mid-1983, the Center has been operated entirely by employees of the AAR's Research & Test Department.

Though slightly constrained financially during its first two years, the new AAR five-year plan calls for generally similar totals over the 1987-91 period. With FRA rail research spending—now almost entirely applied research directly concerned with safety—budgeted at less than $10 million for 1987 (vs. $50 million in 1981, and $20 million in 1982), it's apparent that the AAR portion of rail-oriented research is increasingly crucial to continuing advances in the industry's technological base. Some railroads do maintain significant research programs of their own, frequently in cooperation with the AAR and including major donations of supplies, equipment and facilities to joint test programs, but an increasing part of the rail research "establishment" is represented by the 350 AAR employees located (in a ratio of about 1:3:8) at its three facilities: Washington Systems Center (in the AAR Headquarters building); Chicago Technical Center (on the Illinois Institute of Technology campus); and the TTC (Pueblo).

Particularly disturbing in its longer-term effects is the fact that support for the more basic research in fields of rail interest, of the type formerly funded by the FRA at universities or research institutions, has essentially dried up.

• The tools are good. On the positive side, ingenious use is being made of some of the expensive facilities (the Vibration Test and Roll Dynamic Units and a Simuloader brought up from a Union Tank Line lab in Texas) in the Rail Dynamics Laboratory, and the FAST and other test trackage at Pueblo. A powerful wheel/brake test dynamometer is in business at the Tech Center. With the vast increase in compact, portable data recording and on-the-spot microprocessor analysis capability now available, the efficiency of field testing is dramatically better than it was only a few years ago.

If, simply to stay in business, the rail-



Now in business at the Chicago Technical Center is a wheel brake test dynamometer moved from a U. S. Steel laboratory near Pittsburgh.

roads' need for accelerating the pace of technological progress has intensified while the resources for doing this have diminished, intelligent application of every bit of capability to the problems that really matter has become crucial. Is the AAR's part of the solution—apart from considerations of size relative to need—at least well aimed by the new plan? Perhaps the best handle on that question can come from a look at the process by which it has been refined.

• **Heads in the clouds, feet in the ballast.** Particularly since a major reorganization in 1970 and the arrival of Dr. W. J. Harris—himself a chemical engineer/metallurgist with a background of Navy, Academy of Sciences and Battelle research and laboratory administration—the AAR Research & Test Department has developed a staff with solid credentials in virtually all the engineering, scientific and academic disciplines of concern to rail technology. Effective research in an industrial environment certainly includes some degree of detachment from crisis concerns, but what about potential ivory tower problems?

Administration of the program is overseen by a 22-member Research Committee, chaired by AAR Vice President (R&T) George H. Way, who succeeded Bill Harris last year. Individual members, from large and not-so-large member railroads in approximately the same distribution as on the board of directors of the AAR itself, are typically the senior officers directly responsible for searching out, developing, and applying new technology on their properties—endeavoring to cope with those railroad problems technical and broad enough to suggest that research should help. Given the typical diversity of railroad organization charts at the upper levels, individual responsibilities represented on the committee extend beyond engineering, mechanical, and system analysis to include transportation operations, marketing, and executive functions.

Many line items in the AAR research program—such as those connected with the long-standing Track-Train Dynamics Program with its international governmental and supplier sponsorship—involve some degree of support and concern from organizations outside R&T, as recognized in the membership of steering committees or task forces overseeing specific programs or projects. In the case of the Freight Car and Train Equipment program, for example, the primary such entity is the Research Committee of the AAR Mechanical Division.

In the updated five-year plan, further technical input and counsel on both overall and project-by-project matters from an out-in-the-field, what-we-need-*now* perspective came from 37 R&T staff interviews of 117 officers from 14 major railroads.

If the research program has its ivory-tower aspects, at least the foundation is firmly rooted in the subgrade.

• **The numbers game.** As an aid in the assessment and management of each project, a continuing economic evaluation, calculated on a standardized basis, is maintained. As illustrated in the example (see box, p. 45), research and implementation costs are subtracted from prospective industry-wide cost benefits on a whole-life, discounted basis to generate an estimate of the after-tax net present value of the work represented.

Almost by definition, the success of an applied research project is less than a sure thing. Expected answers may not be found, or solutions may not work out in practice. Accordingly, benefits are reduced by factors—ranging upward from 45% among the projects in the current program—reflecting the probability of research success (that is, producing a useful, workable product) and then by the probable degree of implementation (the proportion of the industry making use of the fruits of the project). Timeliness is addressed by phasing in benefits in terms of cash flow realized year by year as implementation proceeds.

The sum has to be somewhat less than the whole of the parts; to the degree that technically-successful projects may fix the same problem—adopting an optimized wheel-tread contour could reduce benefits from grinding railheads to a scientifically-chosen contour, for example—the savings are not additive. Subject to this caveat, the total for the plan's projects is a substantial $6 billion.

Also of interest are the benefit/cost ratios that can be derived from these figures:

—*Research cost ratio* is the net dollar savings over the useful life of the "product" for each dollar invested in research. This is typically a big number, ranging up into the hundreds for some "knowledge" tasks with little hardware costs and averaging 109 to 1 for the program as a whole.

—*Total benefit/total cost ratio* divides gross savings by the sum of research and implementation costs—those capital and operational expenditures necessary to put the results to work on the railroad. A much smaller number for projects such as the High-Productivity Integral Train Project (HPIT), which can only be implemented by making major capital investment—but also typically for those of high net present value—this still comes in at 5 to 1 for the current program.

Obviously limited in precision by the

AAR research's 1987-91 plan—Continuity, with some shifts

In the planning cycle instituted in 1982, a five-year plan is updated every second year. To portray the major technical thrusts and anticipated shifts in emphasis within the overall AAR research program during the 1987-91 period of the current update, allocations for the eight technical programs are shown for 1986 and for the third and fifth years of the new plan:

Program Subprogram/Project	Annual Allocation ($, thousands) 1986	1989	1991
Energy	3,267	2,006	930
Diesel fuel specifications			
Diesel engine improvements			
Locomotive component efficiency			
Aerodynamics			
Vehicle/track resistance			
Wheel/rail lubrication			
Energy cost modeling			
Fuel measurement instrumentation			
Freight car and train equipment	3,529	3,320	3,579
Car structures			
Brake systems			
Wheel thermal			
Truck performance			
High productivity integral train			
Freight car maintenance cost data base			
Freight car certification			
Certification tests			
Mechanical division standards			
High performance covered hopper			
Track and structures	1,235	2,739	3,729
Track performance			
Rail metallurgy and performance			
Alternate track structures			
Track maintenance planning and costing			
Track failure detection			
Bridges			
Maintenance procedures			
Turnout performance			
Engineering test support			
Engineering committee support			
Vehicle track systems	1,641	3,146	3,546
Track characterization/vehicle response			
Derailment analysis			
Train operations/derailment simulation			
Wheel/rail life			
Wheel/rail profile			
Heavy axle loads			
Relationship of mechanical & track standards			
Wayside/on-board detection			
Track train dynamics implementation			
Coordinated committee support			
Train control technology	704	300	300
Advanced train control systems			
Communication & signal technology assessments			
Environment, safety and productivity	855	1,318	1,323
Employee safety			
Train safety			
Occupational health			
Environment			
Tank car safety			
Hazardous materials			
Hazmat training			
Nuclear waste transportation			
Regulatory analyses			
Freight equipment management	822	924	959
Industrywide car management			
Inter-railroad pooling			
Private car utilization			
Intermodal equipment management			
Car management aids/service planning model			
Motive power management			
Washington computer support			
Technology assessment and engineering economics	434	624	629
Technology implementation			
Advanced technology assessment			
Affiliated laboratories: general funding			
Transportation research board			
International liaison			
Project technical evaluation			
Project economic evaluation			
Facilities and equipment	2,756	3,110	3,060
Operations and management	1,896	1,947	1,947
	17,140	19,443	19,002

These figures do not include research work conducted on contract for suppliers, railroads or government agencies by the AAR at its Pueblo, Chicago and Washington facilities nor the value of material, equipment and services provided or contributed in kind in joint support of programs, typically amounting to $20-25 million per year.

uncertainties within both numerator and denominator, these totals and ratios aren't recommended for making close comparisons among competing projects; but their calculation does tend to insure that all applicable costs and benefits are recognized, that problems addressed are costly enough to support a practical level of research effort, and that all available hard data is factored in. Once available, the analyses can readily be recast to examine such ever-arising questions as the effects of changes in tax laws or the cost of capital in relation to fuel prices.

• **Does it ever end?** What are the "deliverables" of research? With so many of their reports concluding with recommendations for additional work, it's easy to question the reality of the fruits of the endeavors of research's practitioners. Do projects *ever* come to a useful conclusion?

In the new five-year plan, research budgeting for some major items—including the ATCS project, programmed to become self-sustaining with the implementation of its performance specifications a matter of competitive supplier development—phases out within the period.

An aerodynamics project also promises to taper off in classic fashion. First, it is expected that a body of knowledge—including position-in-train, cross-wind and drag coefficient data—will be generated on a spectrum of generic shapes broad enough to encompass foreseeable future rolling stock design and operational planning

needs. After all, cars can be only so long, so wide and about so lumpy. Secondly (as is already being demonstrated in several other projects throughout the research program), this data and expertise will be wrapped up into software programs so neatly that the engineer with a PC can knock out his own aerodynamically-optimized answers.

In balancing differing opinions regarding the relative value and appropriateness of short- vs. long-term research, a stated goal in the selection and phasing of AAR research is that even long-term projects be structured to produce usable products within three to five years.

• **Steady as you go.** It's apparent from the 63 separate items in the five-year plan—many of which contemplate completing or making progress on more than one phase of the problem within the five-year period—that rail technology is not a simple business and there is a lot going on. All we can do is look at major trends and a very few examples.

Overall, the new program, based on maintaining a program at about the level of the new-plateau plans of 1985 and 1986, significantly expands research in track and vehicle-track technology and some safety programs, primarily as permitted by a phasing down of the energy program. The latter shift, certainly to some degree associated with the current price of diesel fuel, results more directly from the anticipated successful completion of landmark programs in measuring and reducing vehicle/track and aerodynamic resistance.

Interestingly, two of the programs tagged for expansion in the new plan do propose to raise efficiency by sprucing up the guided-wheel-on-rail technology that is and always has been the foundation of railroading itself. With the new levels of measurement, test and analytical capability available, the consensus is that a push for improved track and wheel design, material and maintenance standards and further understanding of the dynamics of their interrelation in train consists is not only the next order of business in safety but in the search for sizeable increases in efficiency as well.

• **Wheel on rail—and ramifications.** Traditionally, major increases in efficiency have come about through increased axle loads—doing the job with fewer, bigger cars. Traditionally, also, the transition has been made only to the accompaniment of side effects in the life and serviceability of car and track components so painful as to cast doubt on the value of the trade-off.

Unlikely as such a thing may have seemed at the time of the first five-year plan revision when problems laid at the door of

Research project economic analysis—an example

As a representative example of the application of a variety of available data in support of the on-going calculation of prospective benefit/cost relationships for a specific research project, the AAR economic analysis staff suggests this item, an analysis of the first item in a phased development project included in the current five-year plan as part of the Vehicle Track Systems Program:

Wayside/on board detectors

Objective: To determine the reasons for the increase in the rate of roller-bearing failure and to optimize the methods of detecting incipient bearing failure.

Benefits: Reductions in train delays from stops due to erroneous hot box detections and reductions in derailments caused by true bearing failures. Delays have an economic cost for unproductive time for equipment and labor (FRA estimate: $165 per train hour). The total number of delays industry-wide is unknown; statistics from a small sample of railroads (including statistics on the performance of three types of detectors) extrapolate to a total of 145,000 delays annually, estimated up to 40% from false readings, stopping trains for an average of 25 minutes, for a total of $4.2 million in delay costs.

Bearing-related accidents cost the industry $56.7 million annually (4 year average, factored to include under-reporting and associated non-reportable costs).

Assumptions: On the basis of project manager assessment of project plans and prospects at its current (early) stage, the analysis is based on the following assumptions:

1. Improved detection device will eliminate false hot box indications.
2. Approximately 2,400 hot box detectors in the industry.
3. Improved detection device will reduce cost for accidents caused by true bearing failures by 60%.
4. Capital cost of $5,000 per detector (addition to cost of current device). No increase in number of detectors or operating cos
5. Probability of research success is 70%.
6. Probability of implementation success is 90%.
7. Implementation will begin in 1989 and continue for 6 years.

Project economic analysis
Undiscounted cash flows:
($, thousands)

Year	Research Expense	Implementation Costs Operating	Capital	Industry Savings
1985	0	0	0	0
1986	58	0	0	0
1987	303	0	0	0
1988	328	0	0	0
1989	288	0	1,265	3,981
1990	238	0	1,265	7,962
1991	248	0	1,265	11,944
1992	0	0	1,265	15,926
1993	0	0	1,265	19,907
1994	0	0	1,265	23,889
1995-2000	0	0	0	23,889/yr.
Totals	1,463	0	7,592	226,942
After-tax Present value:	620	0	2,608	57,910
Net present value:				54,682

the 100-ton car were vividly in mind, the largest single allocation in the new plan for the year 1991 is for the Heavy Axle Load project, including validation on the FAST high-tonnage loop of the predicted effects (and resulting economic trade-offs) of axle loads well above the 66,000 pound level. This time around, the stress and dynamic analyses, lab data and system economic models—and even the user-friendly computer programs—allowing a railroad to decide beforehand when, if and by how much it may profitably raise the limits on any of its routes should be available.

Also phased for timely availability are reexaminations (under various programs) of the relationships among time-honored mechanical, engineering and material standards and specifications in the light of more current understanding of track/train interactions—geometry, dynamics, fatigue. Resulting rationalizations (or reaffirmations) in such matters as wheel contour, flat-wheel condemning limits and track geometry limits may well *look* small; anticipated improvements in everything from train resistance and fuel consumption to wheel, rail and ballast life are likewise small in percentage but represent majestic annual savings under a couple of trillion gross ton miles.

• **Assessing the new technologies.** With AAR research projects deliberately oriented toward the short-term end of the continuum, does a new technology not obviously and specifically applicable to some ongoing project or within the purview of a traditional railroad supplier assuredly fall through the cracks and miss out on any chance for industry consideration? Advanced Technology Assessment is a modest continuing program intended to preclude that; within a current general interest in "smart" machines, a completed study of robotics in locomotive back-shop operations is to be followed up in future years with a look at the potential of today's state of the art in "artificial intelligence" (expert systems) in troubleshooting.

Also broadening in-house purview of the less immediate technologies is general funding made available to the technical directors of the AAR Affiliated Laboratories established at four universities (Illinois, Carnegie-Mellon, MIT, and Illinois Tech). Supplementing cooperative and contract work to maintain a modest minimum annual level of AAR work at each lab, this also helps maintain familiarity with railroad technology and fosters quick response to AAR problems in each lab's field of specialization.

• **On the output end.** To do any good, the word has to reach the field. Fruits of some programs show up in the certifications, tests, directives and specifications conducted or promulgated through the AAR's other departments and organizations supported by R&T programs—in the case of the Freight Equipment Management projects, for example, in car service orders. Other research results find their way into the industry through the workings of organizations of professionals such as the Transportation Research Board, the Coordinated Mechanical Committees, and the American Railway Engineering Association.

In the case of the multi-sponsor Track Train Dynamics Program, the research program continues to support meetings of the TTD Implementation Officers designated by each railroad, a gung ho bunch whose work has made "L/V Force Ratio" a household word wherever derailments are found (and, in the process, undoubtedly prevented an impressive, if unknown, number of the same). ■

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